Incorporating "The Illuminating Engineer."

Light and Lighting

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Principal Contents:

Prepare for the Dark Nights!

THERE is a lull on the home lighting front. The light nights of summer alleviate the difficulties of the black-out and, for the time being, render less vital the "synthetic starlight" developed during the past winter. But this respite should be used to perfect arrangements, still far from complete in many cities.

The coming winter will inevitably be a difficult one. It may well be that conditions will be far removed from the comparative tranquillity of the past winter. All the more reason, therefore, to push on with developments now.

In this connection attention may be drawn to the experience reported in Sheffield (see p. 99) that the lighting needs to be installed on a comprehensive scale before its benefits are fully apparent.

The prospect of air raids should hasten these efforts. The amenity value of war-time street lighting in ordinary circumstances is admitted; but the value of this permanent lighting during period of trouble, when much of the present casual lighting from motor car headlights, etc., will not be available, and when those in the streets may need to find their way hastily to shelter in almost complete obscurity, will be great indeed.

I.E.S. North-Western Local Centre

Special Meeting on May 21

A special meeting of members of the I.E.S. North-Western Local Area took place in Manchester on May 21. The President of the Society (Mr. F. C. Smith) and its Honorary Secretary (Mr. J. S. Dow) and J. W. Howell (Chairman of the North-Midland Centre) were amongst those present.

In opening the proceedings the President, who was asked to take the chair, recalled the situation at the outbreak of war, when the Council had determined to do everything possible to maintain the Society's activities. They had subsequently been able to arrange quite a number of successful meetings in London and in most of the local centres. During his term of office he had visited, he believed, all the other centres, and had been looking forward to meeting members of the North-Western Area.

The first business before the meeting was the election of officers and committee, for which he invited suggestions. As a result a committee of eleven members was elected, with Mr. J. Taylor as chairman, Mr. H. E. Chancellor vice-chairman, and Mr. A. H. Owen hon. secretary. Mr. F. J. Palin consented to act as hon. treasurer and to give Mr. Owen assistance in connection with secretarial work.

It was agreed that a message should be conveyed to Mr. Sellars thanking him for his past services to the centre as hon. secretary, and an expression of thanks to Mr. Holton and the Manchester Gas Corporation for the permission to hold the meeting in their lecture theatre in Albert-square.

Some discussion took place on procedure and programme, in the course of which Mr. Howell contributed some useful hints on the gaining of new members and other essential developments.

After the transaction of his formal business, the President gave an address on various aspects of the A.R.P. work done by I.E.S. committees for the Joint Lighting Committee, for which he was accorded a warm vote of thanks at the close of the meeting.

Factory Lighting and the Black-Out

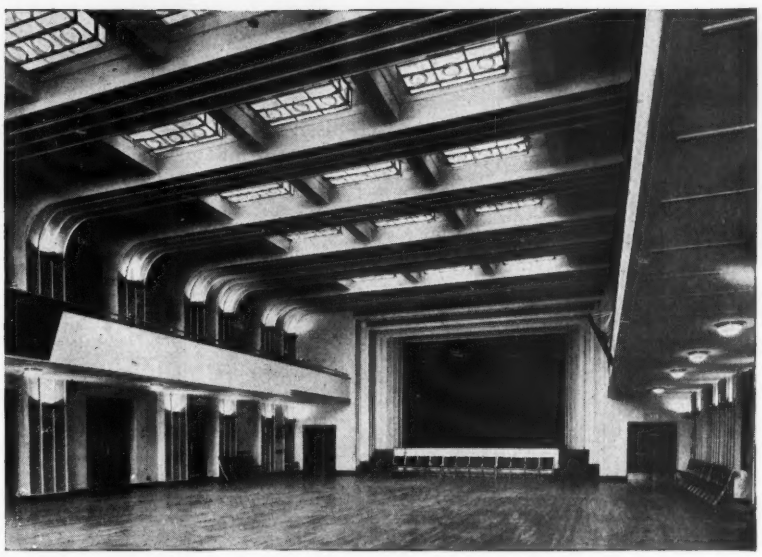
A timely reference to this problem, to which allusion was made in our last issue (May, 1940, p. 76), was included in the remarks of Sir Duncan Wilson at the I.E.S. informal luncheon on May 7. Sir Duncan explained that this question is now being considered by the Home Office Committee on Factory Lighting, and he mentioned some of his own recent experiences in visiting "blacked-out" factories. He had himself formed two main conclusions: (1) That the admission of even a fraction of normal daylight, which can be attained by the provision of shutters and blinds, makes an enormous difference to the amenity of the workshop; and (2) that where this is impossible, much can be done by keeping the ceilings, insides of roof lights, and walls light in colour, and by maintaining a really good and up-to-date system of lighting. These two points are of fundamental importance. There is doubtless good ground for the suggestion, to which Sir Duncan made reference, that in view of the long hours during which workers now use artificial light something better than the average pre-war installation is desirable. But the mere provision of a higher illumination, it is evident, only partly meets the case. Even lighting of high intensity proves wearisome and depressing if there is unrelieved darkness overhead. What is needed is diffusion of light from surroundings—approaching nearer to daylight conditions. Another point well worth notice—especially during periods of bright sunlight such as we have recently experienced—is that daylight itself often needs screening and softening. A bright shaft of light entering through an isolated aperture may be so dazzling as to be positively dangerous. But such an entry of light is useful if only it is diffused by a suitable screen.

Front Lamps for Tram-Cars

A British Standard Specification, recently issued, dealing with this topic (BS/ARP 41) seems a particularly useful one. The degree of light prescribed in the Lighting (Restrictions) Order—which allows 2.5 ft.c. on a vertical surface 10 ft. from the lamp, assuming that two front lights are displayed—is naturally not very great. It has been common experience, however, that very often lights in use did not take full advantage of the limits prescribed and that the distribution of light was by no means the best suited to the conditions—adding greatly to the difficulties of the driver's onerous task. The requirements in the case of a tram-car are substantially different from those applying to a motor-car head light, partly because the course of the tram-car is determined by the rails and partly because of the nature of the source—an electric lamp run off the available supply. It appears, however, that the conditions can be satisfactorily met by a 40 watt lamp backed by a parabolic reflector and provided with a suitable front mask. Such a lamp can be mounted at a height of 3 ft. 6 in. above road level (or, with slight modification) at any height up to 5 ft. above ground level. A main feature is the provision of a mask in which an aperture covered by diffusing material is cut, and which is fitted with a hood extending down to the level of this aperture. This arrangement not only meets the primary requirement of the Order in preventing the emission of light above the horizontal, but also eliminates dazzling of the eyes of pedestrians. The device is fully illustrated and described in an Appendix to the Specification, which should give a valuable lead so that improvements can be introduced before the dark winter months. Incidentally, one apparent advantage of the device, from the standpoint of the passenger, is that it would probably allow enough light to escape sideways to aid the recognition of stopping places.

Modern Lighting in a South African Technical College

In these days it is refreshing to get a glimpse of progress in other lands where as yet war anxieties have not set a limit to developments. A case in point is presented by the new Technical College building in Johannesburg, S. Africa, where special attention has been devoted to the lighting. The adjacent illustration shows the magnificent main hall which the General Electric Company, Ltd., have illuminated by striking methods. Box ceiling fittings, with circular dishes introduced in the centre panels, have been adopted. Around the walls small chromium plated brackets of the indirect bowl pattern are installed, and in the soffit of the balcony there are ceiling fittings to match the decorative bowls in the centre box units. It is interesting to recall that the foundation stone was laid by the Earl of Clarendon (a director of the G.E.C.) at a time when he held the office of Governor-General of the Union of South Africa.



A general view of the main hall of the new Technical College at Johannesburg, S. Africa, where box ceiling fittings have been installed.

Industrial Lighting in War-time

A conference on the above subject took place at the E.L.M.A. Lighting Service Bureau on May 24, when addresses were given by Mr. H. Lingard, Mr. W. J. Jones, and Mr. A. D. S. Atkinson. Mr. Lingard emphasised the fact that under continuous working conditions the average factory depended upon artificial light for 60 per cent. of the average day. The value of good lighting conditions, on which production largely depended, was, therefore, now of special importance. In this connection Mr. Lingard quoted the familiar D.S.I.R. results based on tests of type-setting by hand, and drew the inference that three men working under 20 ft.c. could do as much as four men working at 2 ft.c.

Mr. W. J. Jones, reviewing recent developments in lamps, pointed out that the cost of electricity, owing to abnormal war conditions, had in some instances risen by as much as 40 per cent., whilst, simultaneously, the hours worked under artificial light had greatly increased. The progressive increase in the efficiency of electric lamps was, therefore, proving most helpful at the present moment in enabling efficient levels of illumination to be maintained. He referred to the newly introduced luninescent tubular lamp, which had many advantages in the present circumstances, as a conspicuous example of progress. In works with permanently blacked-out windows 15-25 ft.c. of artificial lighting was now common, with supplementary lighting for special processes, such as those in gauge rooms and in drawing offices.

Mr. A. D. S. Atkinson stressed the need for a complete and efficient black-out, in order that full artificial illumination might be secured at night. New factories were now being built without windows. It appeared that even in such circumstances no complaints were received provided satisfactory conditions of illumination, of the order of 20 ft.c., were provided; but, in any case, it is essential to make suitable provision for ventilation. In conclusion, Mr. Atkinson made some reference to the lighting of external areas and recalled the specifications for fittings providing 0.002, 0.02, and 0.2 ft.c.

Narrow Beams of Light

The lighting restrictions have given an impetus to efforts to design special equipment to produce confined beams of light. Devices of this kind have, for instance, been suggested for use at busy crossings (the idea being that only vertical surfaces, less visible from above, should be lighted to any appreciable intensity). Much ingenuity has also been expended on the design of motor car headlights—though this problem appears to have now been fairly successfully solved by the aid of the official mask. Amongst those who have been devoting attention to these problems is one of the members of the Illuminating Engineering Society, Paymaster-Captain R. R. Hoare, who sends particulars of a new fitting designed to give improved concentration of light. He points out that the usual method of getting a confined beam is to provide baffles cutting off rays except in the desired direction, necessarily an inefficient mode of procedure. Even when the lamp is backed by a circular reflector much of the light is still lost. The method which Commander Hoare advocates involves the insertion of a small reflector within the glass envelope and in close proximity to the filament, reinforcing the forward beam. Side reflectors, preferably parabolic with the filament at the focus of the reflector, are also incorporated. The method can be applied both to tubular and ordinary lamps. Reflecting elements are preferably made of solid glass of appropriate shape, utilising the principle of total internal reflection; silvering, which is liable to tarnish, being avoided. The use of elliptical reflectors, having the property that all light emerging from one focus is collected at another, is also suggested.

The New Unit of Light

Summary of a paper presented by Dr. J. W. T. Walsh at the meeting of the Illuminating Engineering Society on May 7th.

The first successful efforts to establish an international unit of luminous intensity were made in the early years of the present century, culminating in the agreement published in 1909 jointly by the Bureau of Standards, the Laboratoire Central d'Electricité, and the National Physical Laboratory. By this agreement the comparatively small differences between the units in use then in the United States, France, and Great Britain were removed, and a common unit was, from April 1, 1909, adopted in all three countries. In Germany and some other countries the Hefnerkerze continued to be used. Its value was stated to be nine-tenths of the new unit, the constancy of which was maintained at the three national laboratories by means of carbon filament lamps.

At the first post-war meeting of the International Commission on Illumination, held in 1921, this unit was adopted as the "international candle," but was still not accepted by Germany. Both the "international candle" and the "hefnerkerze" were maintained by lamps operating at colour temperatures much lower than those of light sources in common use—even ten to fifteen years ago—and each national laboratory had its own methods of bridging this colour step. In this country the cascade method was commonly used. Other methods were adopted elsewhere. Though, as might be expected, results were not quite identical, fairly satisfactory agreement was attained between the three laboratories concerned so far as regards the "international candle." Unfortunately, however, it soon became clear that this was not the case for the ratio between the two units (int. candle/hefnerkerze), the departure from the accepted ratio increasing with the colour temperature of the lamp to be measured. At the meeting of I.C.I. in 1928 values for the ratio, varying from 1.11 at 2,600 deg. K. to 1.17 at 2,600 deg. K., were tentatively approved, but it was evident that some method serving to establish the unit at any desired colour temperature was needed. Researches on this point were initiated in the various countries. At the I.C.I. meeting in 1931 it was reported that the various national laboratories had agreed to adopt a method of bridging the colour difference by means of blue glass, the transmission factor of which was found by a spectrophotometric determination of its spectral transmission curve, wave-length by wave-length.

In the meantime, the problem of defining a suitable primary standard of light had been revived under the aegis of a Comité Consultatif de Photométrie. The upshot of inquiries addressed to the various standard laboratories was the adoption of sixty candles per sq. cm. as the brightness of a black body radiator at the temperature of molten platinum. (This, it was pointed out, would have the effect of reducing the magnitude of the unit by about 1.8 per cent. at 2,360 deg. K.; but, very fortunately, this change was such as almost to cancel out with an error in the opposite direction, arising from the methods of estimating colour temperatures.)

Proposals in regard to the adoption of this new unit and the specification of the method of passing from one colour temperature to another were embodied in the following resolutions:—

(1) From January 1, 1940, the unit of luminous intensity shall be such that the brightness of a black-body radiator at the temperature of solidification of platinum is sixty units of intensity per sq. cm.
This unit shall be called the "new candle," with appropriate translation into other languages.

(2) (a) The values of the photometric quantities in the case of light sources having a colour other than that of the primary standard shall be determined by a process based on the curve of visibility (luminosity) factors adopted by the Comité International des Poids et Mesures.

(b) To ensure uniformity of procedure among the metrological institutes of different countries when passing from the new primary standard to secondary standards having incandescent filaments operating at higher photometric efficiencies, the method at present adopted is that in which blue filters are inserted between the photometer and one of the light sources to be compared, so as to give a sensation colour match between the two parts of the photometric field.

The new unit adopted in this resolution was to replace both the so-called "International Candle" and the Hefnerkerze, so that there would then be one universally accepted unit of luminous intensity and, consequently, one universal system of units for all the related photometric quantities.

Satisfactory agreement in valuation of the new candle was recorded between the five laboratories interested, in the United States, Germany, France, Japan, and Great Britain, and it was agreed that the new unit should be introduced during the course of the year 1940.

Unhappily, the outbreak of war has prevented ratification of this arrangement. For the moment, therefore, each laboratory will continue to use the old unit until conditions make it possible to effect the proposed change.

The Purkinje Effect

The demonstration of this mysterious photometric effect to an audience is beset by difficulties, and is not always very convincing. At the meeting of the Illuminating Engineering Society on May 7, however, a novel and very successful technique was adopted.

Mr. J. S. Preston, though unable for official reasons to present a paper, gave an interesting demonstration of the Purkinje and field-size effects by a new method, in which the use of fluorescent materials introduced a topical note.

A screen, divided into two rectangles, was coated with materials giving blue and red fluorescence respectively in the two halves. In the darkened lecture theatre ultra-violet irradiation of the screen was gradually raised, uniformly over the area of the screen, by moving up a "black" lamp. At first only the blue half of the screen was visible. Then the red appeared, and gained in brightness on the blue until the two were roughly equal. At this point a mask was placed over the screen to isolate a circular field of roughly 2 deg. apparent diameter, divided along a diameter between the two colours. Inside this circle the blue became apparently much less bright than the red, the field-size effect being thus made evident.

The mask was removed, the two colours again appearing approximately equally bright. The irradiation was then further increased, the brightness of the red half of the screen overtaking that of the blue very substantially, the demonstration of the Purkinje effect being thus completed. The assumption made in this experiment was, of course, that the *physical* brightnesses of the two halves of the screen remained in a constant ratio throughout, the apparent relative change being due solely to the properties of the eye.

A Photometric Artificial Eye

Summary of a paper by G. T. Winch and C. F. Machin, read before the Illuminating Engineering Society, May 7

The above title conveys somewhat briefly the aim stated as the title of this paper ("The Physical Realisation of the C.I.E. Average Eye"). Photometric workers have long had to struggle with the difficulties involved in the comparison of light sources differing in colour and spectral energy distribution. In this respect electric discharge lamps differ greatly from sources of the past. Discrepancies depend on the visual characteristics of the observer, the form and size of the photometric field, and the state of adaptation of the person making the experiment. This variation in observers has been countered by the accumulation of data enabling the performance of the average eye to be set out by a spectral sensitivity curve. The curve thus obtained was approved at the 1939 meeting of the C.I.E.

The realisation of a physical eye apparatus, having the spectral sensitivity of the average eye, has been the aim of many investigators. The design depends on the choice of receiver, which may be (i) thermopile, (ii) rectifier photoelectric cell, (iii) emission type of photoelectric cell, and (iv) electron multiplier type photoelectric cell. The thermopile has the merit that its response should be uniform throughout the spectrum. Modification is effected simply by the filter used. Unfortunately, however, the sensitivity is very low. Although rectifier cells are much more sensitive their low resistance makes valve amplification impracticable. With emission type cells, on the other hand, amplification is possible. This type presents great advantages, especially as (in the types used by the authors) the photoelectric current is proportional to the incident light within wide limits. The stability is also good.

The next question is the method of securing the desired spectral sensitiveness throughout the spectrum. Colour filters have been used for this purpose, but the design and construction of filters suitable for exact imitation of the average eye presents great difficulties. The authors preferred the "dispersion and mask" method. This involves the dispersion of light in a spectrometer by means of a prism and the interposition of a mask of special contour, such that the overall spectral response is the same as that of the average eye. The light thus modified is brought to a focus and concentrated on the physical receiver, in this case a photometric cell.

The authors described in detail the construction of their apparatus, at first in a form with a small aperture and a fixed mask, later on a bigger scale, with a larger aperture and an adjustable mask. The universal photoelectric photometer (shown at the exhibition of the Physical Society in 1935) proved very useful in this connection. Considerable care had to be devoted to the precision manufacture of the mask. As an illustration of the accuracy required, the measurement of light from a sodium lamp, 99 per cent. of the radiation of which is concentrated at the D line (at 0.5896 μ is mentioned. In order to obtain a photometric accuracy of 1 per cent. the height of the fixed mask at this wavelength must be correct to within 0.01 cm.

In the later apparatus with the variable contour mask the masking was performed in the main by a template of approximately the correct shape. The final adjustment was, however, made in situ by the movement of series of leaves. Some investigators have adopted a combination of colour filter and mask, the latter being used only for the fine adjustment. The authors, however, found that the work involved in the preparation, testing, and fixing of such a filter was hardly justified. Special care was taken to eliminate stray light. It was found that the percentage impurity of any wavelength was of the order of 0.3 per cent., which was considered satisfactory. The adjustment of the mask contour was performed with the aid of a source of radiation of known spectral distribution, namely, a 2-kW. tungsten filament lamp operated at 3,120 K.

In the discussion of results and applications of the apparatus the authors gave encouraging figures derived from tests of various sources yielding light of widely different colours, including mercury, sodium, and neon lamps. The maximum divergence of the physical from the visual measurement was of the order of 5 per cent. Other applications include the study of integral transmission of colour filters, the measurement of luminosity in special bands, and direct physical colorimetry.

Street Lighting under War Conditions

(Supplement to BS/ARP 37)

Several important additions to the above specification, relating particularly to the treatment of exceptional conditions, where the spacing is unusually close, have recently been issued, as follows:

Page 2, Clause 4. Mounting Height and Spacing:— To be revised to read as follows:—

The light distributions prescribed in Clause 3 are associated with nominal mounting heights of 10, 15, and 20 ft., as marked on the fittings (see Clause 8). Fittings having these distributions may be mounted at heights as shown below, provided that the spacing of the lighting fittings, measured along a line joining them in plan, is not less than 100 ft.:—

Range of mounting heights for which the fitting may be used.	Nominal mounting height as marked on the fitting.	Light distribution to be within limits of:—
9 ft. — 14 ft.	10 ft.	Fig. 1
14 ft. — 19 ft.	15 ft.	Fig. 2
19 ft. and upwards	20 ft.	Fig. 3

Where the spacing of the fittings, measured along a line joining them in plan, is less than 100 ft. but not less than 50 ft., and where it is inconvenient to use every second or third column, the fittings to be used and the actual mounting heights shall be as follows:

Direct distance between fittings.	Actual mounting height.	Fittings adopted to be suitable for nominal mounting height, as marked on the fitting, of:—	Light distribution to be within limits of:—
Less than 100 ft. but not less than 50 ft.	9 ft. — 14 ft.	10 ft. SS	Fig. 4
Less than 100 ft. but not less than 75 ft.	14 ft. — 19 ft. 19 ft. and upwards	10 ft. 15 ft.	Fig. 1 Fig. 2
Less than 75 ft. but not less than 50 ft.	14 ft. — 19 ft. 19 ft. and upwards	10 ft. SS 10 ft.	Fig. 4 Fig. 1

It is also directed that, in Clause 8, p. 3, on "Marking," the letters "SC" or "CC" (indicating "single coil" and "coiled coil" filaments) should be added.

Yet another correction, in Fig. 3, p. 6, is the substitution of 0.065 for 0.06 candle on the extreme left of the diagram.

New Lighting in the Savoy Chapel

The King's Chapel of the Savoy, which is the personal property of the King, as Duke of Lancaster, has recently been renovated, following His Majesty's decision to grant the use of the Chapel to the Royal Victorian Order.

A robing room and a new cloister have been built and other additions and alterations made which will enable the Chapel to be used for the first time for ceremonial processions, the architect for this work being Mr. Malcolm W. Matts.

An early Italian painting of the Madonna, said to have been given by Chaucer, has been placed in the wall above the altar.

The beautiful ceiling of eighty-eight wooden panels has been cleaned and retouched to a parchment shade and can now be seen to full advantage owing to the concealed lighting from the base of the stained glass windows, which lights the whole of the interior of the chapel and at the same time enables the stained glass to be seen from outside by transmitted light.

The lighting was carried out by Messrs. G.V.D. Illuminators, Ltd., to whom we are indebted for the pleasing illustration, showing the appearance of the chapel by artificial light, which appears above.

Electroluminescence

A new form of luminescence effect was reported by Dr. H. H. Race at the recent convention of the American Institution of Electrical Engineers. In the course of some tests of synthetic insulating liquids a blue glow was observed between the electrodes submerged in the liquid. Increasing the voltage intensified the brilliance of the glow until the insulation broke down and a discharge took place. The glow was observed in gas-free liquid, and the presence of even a small amount of gas completely quenched it. Attempts were made, but without success, to obtain similar electroluminescence in mineral oils.

War-time Street Lighting in Sheffield

We learn with interest that considerable progress has been made, under the supervision of the public lighting engineer (Mr. J. F. Colquhoun), in the adoption of war-time street lighting in Sheffield. In that city there are now 16,000 of the new fittings installed, and it is anticipated that the remaining 8,000 street lamps will be similarly treated by the end of July. The results have proved very satisfactory. At a recent meeting of the Sheffield Safety First Council a resolution was passed expressing appreciation of the speed and efficiency with which the modified street lighting has been installed, and affirming its value to road users in mitigating black-out conditions.

There is one particularly useful lesson to be drawn from this experience, namely, that where the lighting is installed on a large scale, as in Sheffield, there is usually no doubt in regard to its benefit. The appreciation of the public amounts to heartfelt gratitude. Where, on the other hand, the system is only applied to a few streets, or perhaps even only to a section of one street, its value is not so evident, and there is some danger of an erroneous impression that it is not worth while.

Holophane Bulkhead Units

An illustrated leaflet issued by Holophane, Ltd., draws attention to the popular circular bulkheads and "Widerlite" fittings, much in use at the present time. Such units are invaluable when overhead space is limited and a compact and robust "close to the wall or ceiling" fitting is needed. A feature of the special Holophane units, however, is that one drawback to the ordinary bulkhead fitting—incompleteness in control of the distribution of light—is remedied by the special prismatic cover glasses. In this leaflet the Holophane flameproof units for use in petroleum industries, cellulose spraying shops, chemical works, etc., are also illustrated.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 80, May, 1940.)

II.—PHOTOMETRY

124. The Cylindrical Web for Isocandles.

B. Monash. Am. Illum. Eng. Soc. Trans., 4, pp. 374-377. April, 1940.

An isocylindrical web valuable in the representation of light distributions is described. It enables the amount of flux emitted to be calculated as with the "onion" diagram, but has the additional advantage of representing a complete sphere instead of only a hemisphere. J. S. S.

125. The Calculation of Illumination from Sun and Sky.

E. Elvegard, G. Sjostedt. Am. Illum. Eng. Soc. Trans., 4, pp. 333-342. April, 1940.

Formulae are given expressing the connection between solar altitude and the illumination from sun and sky on a horizontal surface. The values of the constants in the formulae are deduced from data obtained in Scandinavia, but it is stated that there is little change in the average values in other localities. J. S. S.

IV.—LIGHTING EQUIPMENT

126. Illuminated and Non-Illuminated A.R.P. Signs.

British Standard Specification, B.S./A.R.P. 32.

A revised version of this specification in which the dimensions and lettering of such signs are defined, and means of artificial lighting are now more fully illustrated. J. S. D.

127. Colours for Signal Glasses for Railway Purposes.

British Standard Specification, No. 623. 1940.

A revised version of this specification in which the colorimetric properties and transmittance of glasses for railway signal work are defined. J. S. D.

128. Polaroid Fixtures Help in Drafting Room.

G. A. Kane. El. World, 113, p. 920. March 23, 1940.

In addition to the general lighting a single polaroid fixture is used at each drawing board, equipped with four 50-watt filament lamps or two 30-watt fluorescent tubular lamps. Illumination values between 30 and 60 ft.c. are obtained, according to the adjustment of the local unit, as made by the individual draughtsman. It is claimed that glare is eliminated. S. S. B.

V.—APPLICATIONS OF LIGHT

129. Light and Architecture.

Anon. Am. Illum. Eng. Soc. Trans., 4, pp. 321-326. April, 1940.

Some representative architectural lighting schemes are described with photographs. J. S. S.

130. Luminous Hoods for Newspaper Presses.

Anon. El. World, 113, p. 926. March 23, 1940.

Details are given of the lighting of a newspaper press-room by means of large low-brightness diffusing panels. Average brightness is 190 foot lamberts (or e.f.c), the illumination on the press cylinders varying from 7-18 ft.c. Shadows and glare have been eliminated. S. S. B.

131. 30 ft.c. Speed Knitting Mill Output.

Anon. El. World, 113, p. 928. March 23, 1940.

Details are given of the lighting system adopted for the main knitting-room of a silk stocking factory. Special industrial asymmetric prismatic units have been used. The illumination at the knitting points is 25-30 ft.c., good lighting being of great importance, since the production machines are extremely complex, and a breakdown causes serious delay. S. S. B.

132. Trough Lighting in Industry.

M. A. Mortensen. Magazine of Light IX., No. 2, p. 30. February, 1940.

An installation, stated to be the first, of fluorescent tubular lamps for industrial purposes is described. The installation is in a factory of the Cleveland Lamp Works. C. A. M.

133. Colour Matching at the Forbes Varnish Company.

R. F. Wysocki, A. K. Gaetjens. Am. Illum. Eng. Soc. Trans., 4, pp. 343-350. April, 1940.

The design of a booth for the colour matching of lacquered and enamelled samples is discussed. Thirty-six tubular daylight fluorescent lamps are used, arranged in three banks to provide a range of illuminations. Precautions are taken to avoid any specularly reflected light from reaching the eye. J. S. S.

134. Evaluating Visibility on Lighted Streets.

Kirk-M. Reid, H. J. Chanon. Magazine of Light, IX., No. 2, pp. 23-25. February, 1940.

A description is given of the apparatus, housed in a car, that is used in studying the conditions governing visibility in a given street lighting installation. C. A. M.

135. Street Lighting Much Increased—Negligible Increase in Bill.

C. H. Anderson. El. World, 113, p. 1363. May 4, 1940.

By the proper use of modern equipment, and a carefully studied plan of modernisation of existing facilities, an American city increased its street lighting by 32 per cent. at an increase in running cost of only ½ per cent. The scheme adopted, and details of the equipment are given. One interesting point is the use of fibre glass insulation for the wiring in totally enclosed fittings. S. S. B.

136. Daytime Lighting of Tunnel Entrances.

Anon. El. World, 113, p. 1238. April 20, 1940.

The necessity of providing suitable grading of lighting intensities in the neighbourhood of tunnel entrances and exits is discussed, and a graph is given from which this grading can be determined. Intensities of the order of 100 ft.c. of artificial illumination should be provided at the mouth of the tunnel in the daytime. S. S. B.

137. External Plant Lighting for Safety.

D. M. Diggs. Am. Illum. Eng. Soc. Trans., 4, pp. 351-360. April, 1940.

The design and application of lighting installations for the prevention of crime, and in particular of sabotage, are discussed. J. S. S.

138. Light, Sound, and Air Conditioning.

W. G. Darley. Magazine of Light, IX., No. 2, pp. 27-28. February, 1940.

A system of coffer lighting, designed to suit the requirements of acoustics and ventilation, is described, with photographs. Tubular fluorescent lamps are used. C. A. M.

139. 50 ft.c. with Fluorescent Lamps.

J. C. Forbes. Magazine of Light, IX., No. 2, pp. 31-33. February, 1940.

The conversion of the Tungsten lighting equipment of a floor area of 10,000 sq. ft. to installations using tubular fluorescent lamps is described. C. A. M.

140. Fluorescence in Display.

Anon. El. Times, 97, pp. 287-288. April 4, 1940.

Describes and illustrates the application of luminescent effects to a display of ornamental brickwork. Artificial flowers are used very effectively in this display. W. R. S.

141. Fluorescent Down-lighting.

W. J. Eby, N. D. Baker. Magazine of Light, IX., No. 2, pp. 15-16 and 35. February, 1940.

Details are given of the successful use of fluorescent tubular lamps, both for the window and the interior of a drug store in America. Contour and light distribution data of one of the fittings used are given. C. A. M.

142. Lighting the New York World's Fair.

Richard C. Engelken. Elect. Engineering, 59, p. 179. May, 1940.

A very full and detailed description is given of the lighting equipment and effects used at the New York World's Fair. Numerous diagrams and photographs are used to illustrate the features described. New materials and special designs are extensively used, but for decorative effect and utility purposes. S. S. B.

143. An Electronic Switch for Fluorescent Lamps.

R. F. Hays. Electronics, 13, No. 5, p. 14. May, 1940.

The combination of a thermal switch using a gas-discharge and series inductance is used, eliminating the necessity of high voltage transformers to produce the transient voltage required to start a fluorescent lamp. This switch is claimed to have many advantages. Full details of the switch and associated circuit are given, and factors in the design and operation of the switch are discussed. S. S. B.

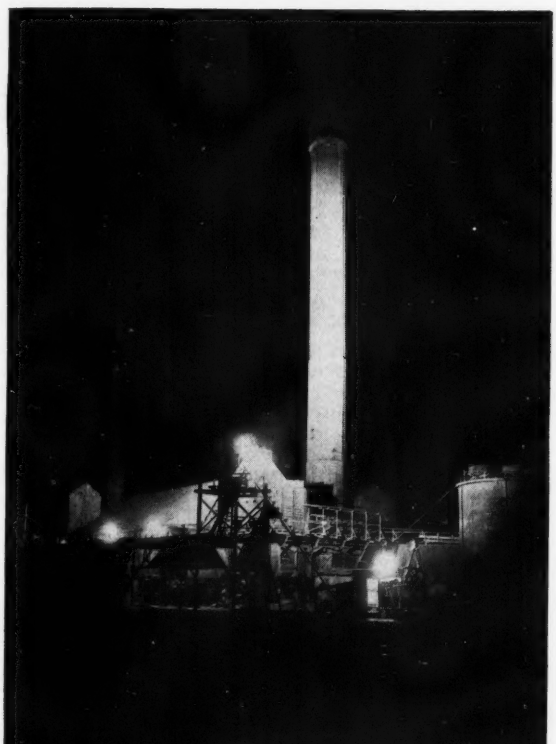
Floodlighting a Factory Chimney in Australia

Interesting Treatment of an Aerial Obstruction

Shortly before the outbreak of war several experiments were proceeding on floodlighting tall chimneys.

In this country in peace time all high buildings, wireless masts, and other erections likely to obstruct aircraft should be identified by means of red obstruction lights. This stipulation has, in the case of tall chimneys, been a great source of difficulty. It has been necessary in many cases to install gear for raising and lowering the fittings which, owing to the heavy deposits formed by the smoke from the chimneys, require cleaning almost continually.

Floodlighting was, therefore, considered as an alternative, but the question of its practicability was not finally settled by last August, partly owing to doubt in regard to the intensity of red light that could



A view of one of the chimneys near the Perth Airport in Australia floodlighted at night. Attention may be drawn to the even distribution of brightness—a condition which had previously proved difficult to achieve.

be secured and partly because it seemed that narrow beams from individual floodlights might prove embarrassing to pilots.

An interesting example from overseas—the lighting of five chimneys near the Perth Airport in Australia—is now available. The British General Electric Co. Pty., Ltd. (the G.E.C.'s branch company in Australia), was called in by the Commonwealth Works Department to assist in solving this somewhat difficult problem.

The chimneys are 200 ft. high and constructed of red brick, which, it will be recalled, has a low reflection factor. It was desired that the light centre should fall towards the top of the chimney and that the fittings should stand up to adverse weather conditions. By utilising 1,000-watt Osram projection lamps in suitable robust projectors, a strong narrow beam was provided and the desired effect—illustrated above—was obtained.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 513,523. "Improvements in or relating to Photo-electrically Sensitive Surfaces."

Klatzow, L. Dated March 7, 1938.

This invention relates to photo-electrically sensitive surfaces, as used in connection with photo-electric cells, television transmitting apparatus, etc. In particular it refers to photo-electrically sensitive cathodes incorporated in television transmitting apparatus, on to which an optical image of an object is projected. The photo-electrons are focussed upon a substantially non-photo-sensitive mosaic screen charging its elements. The latter are being restored periodically to a given potential by scanning with a beam of cathode rays. The photo-electrically sensitive layer used for these purposes should, it is proposed, consist of a compound of antimony, formed with an electrically conductive element (an alkali metal), and should be rendered photo-electrically sensitive by treating it with caesium. Applying the invention to the photo-sensitive cathode in transparent cells, it is easily possible to obtain a layer thin enough to be transparent, and at the same time to maintain the good conductivity over its whole area, in spite of the baking process.

No. 513,524. "Improvements in Photographic Printing Machines."

Child, A. J., Hall, J. C., Smith, W., Stobart, J. W. Dated March 10, 1938.

This specification refers to photographic printing machines of a type in which an image of a picture strip is projected upon a sensitised strip, the latter moving in synchronism with the former. The light beam is reflected from the picture strip through a lens system on to the sensitised strip. According to the invention, a main shaft is directly geared to a pair of countershafts, each having an axially displaceable driving connection with rotable discs. These oscillate a plate in guides which, in its turn, by means of feed dogs engaging with perforations in the picture strip and sensitised strip respectively, ensures synchronous movement of picture and sensitised strip.

No. 513,546. "Improvements in Electric Light Fittings."

Scott Adie, K. Dated April 13, 1938.

The invention refers to reflector fittings designed for use with mercury discharge lamps in conjunction with tungsten lamps for the purpose to counterbalance the absence of red rays in mercury lamps. The specification provides for the mercury lamp to be mounted centrally and above a group of tungsten lamps. In addition, the mercury lamp is wholly or partly screened by means of a glass filter (preferably green glass). The filter provided is, broadly speaking, either made up in a cylindrical shape consisting of a number of flat glass strips; or, in case the mercury lamp is working in a horizontal position, the glass strips are fitted into a flat frame extending transversely within the reflector, and arranged to surround the lower half of the mercury lamp. In special cases the filter should be provided as an integral part of the lamp, i.e., it should be placed within the bulb of the lamp, covering the actual discharge tube.

No. 513,583. "Improvements in or Relating to Electric Discharge Lamps, comprising Material adapted to be excited to Luminescence by an Electric Discharge."

General Electric Company. Dated March 8, 1938. (*Convention.*)

The improvement proposed is based on an earlier Patent Specification (No. 480,356). Herein it was proposed to use as luminescent material in fluorescent tubes (mercury discharge) an activated zinc-beryllium silicate and to mix with it for certain purposes a material yielding blue luminescent light, in particular calcium tungstate. But the addition of blue light inevitably decreases the relative amount of red light emitted and, therefore, if this decrease is inconvenient, blue and red light must be added in suitable proportions. It has been found that materials yielding under excitation by the mercury spectrum a suitable proportion of blue and red, are matrixes of tungstates activated by samarium. Other activators, e.g., bismuth, lead, copper, silver, or some mixture of them, may be associated with them. Without changing the luminescence due to the presence of the samarium they may add other components to the spectrum of the light emitted. A suitable material is calcium tungstate activated by 0.7 per cent. of samarium plus 0.5 per cent. lead. The zinc-beryllium silicate associated with this material preferably contains 1.5 per cent. to 3 per cent. of manganese.

No. 513,584. "Improvements in or Relating to Luminescent Substances for Electric Discharge Vessels."

S.A. pour les Applications de l'Electricite et des Gaz Rares Etablissements Claude Paz et Silva. Dated February 3, 1938. (*Convention.*)

The specification deals with fluorescent substances consisting of salts of acids comprising oxygen, e.g., zinc silicate, cadmium silicate, and calcium tungstate. The luminescent substance, according to the invention, has a luminescent salt of an oxygen-containing acid and a small portion, in the free state, of an oxide of beryllium, magnesium, or aluminium. When use is made of such a substance the initial output is appreciably greater than that of the same substance without oxide. The rate of decrease in output, however, is the same. Consequently it has a higher efficiency for a longer period. The oxide constitutes only a small proportion of the luminous substances, e.g., 5 per cent. to 10 per cent.

No. 513,586. "Process and Means for the Production of Vacua."

Eastman Kodak Company and Hickman, K.C.O. Dated March 11, 1937. (*Convention.*)

The invention refers to improved methods of high vacuum production and improvements in condensation and ejector pumps. An organic fluid is employed in a condensation pump combined with a steam ejector as backing pump. Organic fluids which may be employed should be capable of withstanding vaporisation under the relatively high boiler pressures without substantial decomposition. As a general rule it may be stated that the lower the vapour pressure of the pump fluid the lower must be the backing pressure.

NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

Switzerland

Mr. Bucmueller, in the "Bulletin de l'Association Suisse des Electriciens," discussed recently deficiencies inherent to measurements with photocells. Deviations from the correct values become greater with increasing angles of incidence. They may be caused either by the shadow cast by the cell frame, by the reflection from the covering glass, or by the filters. In the case of one form of cell he finds that the deviation amounts to 4 per cent. at an angle of incidence of 50° and to 12.8 per cent. with an angle of 80°. Several suggestions have been made to overcome this difficulty, e.g., the provision of a perfectly diffusing glass cover or the use of a small integrating sphere with the cell built in, the light being admitted through a hole in the sphere. Improvements by such means, however, have in most cases been achieved at the expense of sensitivity and, in particular, have not been considered satisfactory for outdoor measurements. Here generally use is made of tables of correction—factors supplied by the maker and the correct value found by calculation. The author proposes a new method of determining the true value of illumination on the spot by making supplementary measurements. For this purpose the cell is mounted on a lever-arm permitting it to be used both in a horizontal and vertical position. A set of four adjustable diaphragms can be arranged to restrict the working area of the cell surface to any desired value and to restrict the angle of access of the incident light. In a case where correct measurements have been made with the cell in both the horizontal and vertical positions, the sum of both represents the true value of illumination. In this way the deviation from true values can be diminished to a maximum of 3 per cent. as compared with 12.8 per cent. mentioned above. The particular method adopted, however, is applicable only where illumination measurements are to be taken under a number of light sources suspended in a line. In cases where light points contributing to the illumination to be measured are grouped in various ways, e.g., round a square, other methods have to be applied.

United States

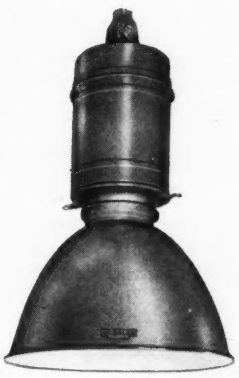
Mr. R. Swetland reports in the "General Electric Review" on modern trends in Lighting of Vehicular Tunnels. The increased attention which tunnel lighting problems have received in recent times is explained by the extraordinary great hazards involved and the increasingly important role lighting is playing in diminishing these hazards. Increased traffic density, the constant trend towards accelerated traffic flow, the growing number of Diesel engines and the consequent interference with proper vision caused by exhaust vapour are all real factors necessitating adequate lighting provisions. The amount of illumination to be desired varies with the local conditions. It depends in the first place on the length and width of the tube, also on the average speed and the direction (one-way or two-way) of the traffic, its density, and the reflecting properties of the lining and the road surface. Most of the old installations have a spotty effect and give average illuminations of no more than 0.5 to 1 ft.c. Modern installations (e.g., the McCallie Avenue Tunnel [Chattanooga, Tenn.] or the Stockton Street Tunnel at San Francisco) furnish 2.5 to 4 ft.c. In the past, on the other hand, lighting arrangements, particularly those with tungsten lamps in pairs opposite each other and in a recessed position at about 20 ft. spacing, gave a highly satisfactory degree of uniformity, in some cases about 2.1. To-day, however, uniformities of 4.1 or 5.1 are considered sufficient. In cases of 14 ft. ceiling height tungsten luminaires in pairs opposite each other are spaced at 30 ft. intervals and sodium luminaires even wider, 30 to 40 ft. Ceiling heights of 20 ft. and more allow for spacings up to 60 ft.

Efficient control of light distribution is, of course, of much importance in connection with tunnel lighting, and high quality fittings are needed. For use with tungsten lamps a "spun-on-globe" design is recommended, very similar in construction to the new street lighting fitting (previously described here), but shorter in its overall dimensions. 300-watt tungsten lamps are used. For sodium lamps half-cylindrically shaped fittings, used in a recessed position, are adopted. The choice, in wiring, of multiple or series circuits depends on the length of the tunnel, the positions of transformers, and available duct space. One of the main problems in connection with tunnel lighting concerns the entrances, i.e., the minimisation of hazards on entering the tunnel at high speed. When one is travelling at 35 to 40 m.p.h. 200 ft. are required for safe eye adaptation. Some effective solutions are mentioned. The first provides for an overhead louvered ceiling construction built for a distance of some 200 ft. in front of the tunnel portal. It is designed to prevent direct sunlight reaching the ground underneath, and serves to produce a diminishing level of daylight as one approaches the tunnel entrance. (In northern climates this construction may have its disadvantages during the winter as the pavement underneath the structure tends to become ice-covered.) Another method provides for increased artificial illumination within the tunnel for the first 200 or 300 ft. to counterbalance the fading daylight over this section. It is stated that with an entrance area of 14 ft. height and 28 ft. width daylight diminishes to zero on a length of 250 ft. To make the transition comfortable it is required to provide 3 ft.c. in addition to the normal level of artificial illumination prevailing inside the tunnel. (This value of 3 ft.c. is suggested for a proposed outdoor illumination of some 500 ft.c.)

Finally, the application of sodium lamps is strongly advocated, in view of the high luminous efficiency (55 lm/w) and the long life (4,000 hours). The 10,000 lm. type is preferred. In general it can be estimated that for a given level of illumination sodium lamps in tunnel lighting will offer a saving of 30—80 per cent. of annual maintenance costs compared with tungsten lamps. There is not sufficient experience as yet available in regard to mercury and fluorescent lamps in this field of application.

Mr. H. H. Skilling gives a description of the Bol lamp in "Electrical Engineering." The lamp, named after its designer, Mr. Cornelis Bol, Stanford University (formerly Philips, Eindhoven), is a high-pressure mercury vapour lamp of 100 atm. with a luminous column of 1 cm. length, consumes 500 w., and works on a pressure of 350—500 volts. It is specially designed for use with the oscillograph. Its main advantages for this application are high intensity of light and ease of operation. Its brightness facilitates greater photographic speed and the use of relatively insensitive photographic media, e.g., Bromide paper, which is cheaper than film and easier to handle, and requires no photographic printing. Panchromatic emulsions are unnecessary with the Bol lamp. Proper recording on Bromide paper is possible at speeds up to 50 ft. per second, and, if sensitive film is used, at speeds of several hundred feet per second. To overcome the stroboscopic effect it is recommended to run the lamp on 500 cycle a.c.

"Low Temperature" Industrial Lighting Fittings



Mazdalux Low Temperature Industrial Fittings have now been developed for Mercra discharge lamps, the choke being built in above the reflector, as shown in the illustration. Easy access to the choke terminals is gained by simply removing three screws and lifting the top cap. The overlamp type of reflector is designed to facilitate easy maintenance, as it can be instantly removed for cleaning—no screws, clips, or other loose parts being used.

The Illuminating Engineering Society (U.S.A.)

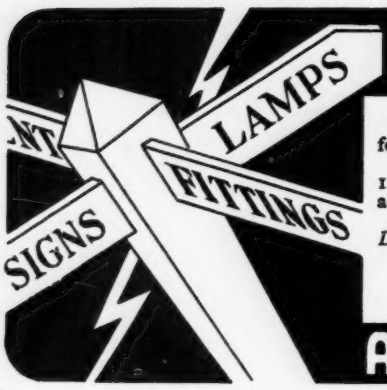
Notes on Transactions (May, 1940)

NEWS: A "*Recommended Practice for the Illumination Performance of Residential Ceiling Luminaires*" has been prepared by the I.E.S. Committee on Residence Lighting approved by the Council and released after four years of work on the subject. The formation of *an Advisory Board of Design*, headed by W. A. Kimbel, has been announced by the chairman of the American Lighting Equipment Association. Its object will be to correlate the views of the illuminating engineer, the lighting fixture manufacturer, and allied design practitioners. Ten years ago the *first Baseball Play Field Lighting Installation* was put into use at Des Moines, Iowa. To-day seven out of ten games in the minor leagues are played under artificial illumination. The Sales Committee of the Edison Electrical Institute has decided to encourage the proper technical development of fluorescent light sources and *to promote such lighting equipment as will provide a power factor of 90 per cent. or more.* At the Detroit Builder Show the "1940 Ideal Home" was largely equipped with fluorescent lighting. The full lighting load amounted to 52 kw. installed in twenty-seven rooms. "*The I.E.S. Award for Lighting and Architecture*" has recently been established as an annual award to architects by the I.E.S., Australia.

CONTRIBUTIONS: *Directional Flashing for Motor Vehicle Signals*, by P. H. Chase. To be effective a motor vehicle signal should comply with the requirements of being readily understandable, lucid, and emphatic. Two methods of flashing are adopted: "plain" flashing and "directional (sweep)" flashing. For experimental installations two 3-lamp signal units of different sizes were selected, the total area of the rear signal being 9 sq. inches and of the front signal 6¾ sq. inches. The lamps used were 6-volt automobile standard lamps of 3, 6, and 15 c.p. Flashing was effected by voltage variation either 0-6-0 or 3-6-3. A moderate, efficient flashing rate is 60 to 90 per minute. It is concluded that fully effective direction signals are produced by characteristic sweep flashing, not necessarily combined with any particular signal shape (such as arrows, etc.).

A Study of Chalkboard Visibility, by W. G. Darley and L. S. Ickis. The authors present results of over 2,000 separate relative visibility measurements made by means of the Luckiesh-Moss Visibility Meter. Fourteen different commercially available boards, each 12 x 18 inches, were prepared for the tests. The class room dimensions were 22 x 27 ft. The artificial illumination was provided by four indirect luminares two of 500 watts each and two of 750 watts each. Furthermore, special board lighting was provided. The illumination on the vertical samples was 17 ft.c. from the general lighting and 16 ft.c. from the supplementary lighting. The study substantiated the general contention that high contrast is necessary to obtain good visibility, and also that special chalk board lighting is highly desirable.

Specification of Optical Requirements of Electric Headlamps of the Sealed Beam Type for Motor Vehicles. This specification covers the requirements for interchangeability and photometric tests of "sealed beam" headlamp units.



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Index to "Where to Buy"

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 106—107)

"Sieray" Fluorescent Tube

We illustrate below the "Sieray" fluorescent tube which utilises the new tubular lamp giving a light of high efficiency closely resembling daylight in colour effect. This follows a number of other developments introduced by Siemens Electric Lamps and Supplies, Ltd., with a view to furnishing light of good colour-revealing quality. The "Blendalite" system is an instance. The new lamp now illustrated, however, is a more fundamental advance, being remarkable not only for the high efficiency (35 lumens per watt) and good quality but also for the fact that the light emitted is obtained entirely mainly from the fluorescent powder with which the interior of the tube is coated. For fuller details of this new lamp readers may be referred to the account in a previous issue (March, 1940, p. 51). The highly diffused and soft character of the light, together with the fact that its colour-revealing qualities approach so closely to artificial light, render it ideal for many special industrial processes, especially in view of the present black-out conditions, which so often result in the exclusion of daylight from factories.